Hot Springs National Park, Bathhouse Row:
Mechanical and Piping Systems
One mile north of US Highway 70
on State Highway 7
Hot Springs National Park
Garland County
Arkansas

HAER No. AR-4

HAER
ARK,
26-HOSP,
3-

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
P.O. Box 37127
Washington, D.C. 20013-7127

HAER
ARK,
26-HOSP,
3-

HISTORIC AMERICAN ENGINEERING RECORD

HOT SPRINGS NATIONAL PARK, BATHHOUSE ROW: MECHANICAL AND PIPING SYSTEMS

HAER NO. AR-4

Location:	Hot Springs National Park, Carland County, Arkansas. One mile north of US Highway 70 on State Highway 7 (Central Avenue).
Date of Construction:	1912-1923
Present Owner:	National Park Service
Present Use:	Presently vacant with the exception of one bathing facility (Buckstaff) and one visitor touring facility (Fordyce).
Significance:	Bathhouse Row represents a typical American Spa. The spring piping, heating and ventilation systems are examples of early twentieth century state-of-the-art technology.
Historian:	Diana Prideaux-Brune August 1987

[See HAER Nos. AR-4-A through AR-4-I for individual structure reports.]

[See HABS No. AR-28 (A through I) for documentation of the architectural features of the bathhouses on Bathhouse Row.]

CONTENTS

INTRODUCTION

In a 1945 study, it was established that there existed "less than ten" resort spas in the United States that were under the direct control or supervision of a federal, state, or municipal government agency.[1] Hot Springs National Park is unique in this group as it has been under federal ownership since 1832. As a resort spa on federal land, the park's entire history has been marked by the conflict between commercial interest in the hot mineral waters, and the federal government's mandate that the Hot Springs "be reserved for the future disposal of the United States."[2]

The earliest development of the springs resulted from private efforts, with little or no restrictions from the government. As the value of the springs became apparent, government intervention increased to bring the greatest possible benefit to visitors of the Park. Today, although all but one of the bathhouses on Bathhouse Row is vacant, the government maintains full ownership of the facilities.

The development of the bathhouses' mechanical and piping systems provides a concrete example of the interplay between private and government interests. The bathing facilities have always been commercial undertakings, and as such, have been based on competition and profits. Combatting the mercenary instincts of the bathhouse owners, government agencies were constantly arguing for better standards for bathing facilities, and for long-term plans for the preservation of the natural advantages surrounding the springs. The unusual partnership resulted in interesting solutions to the more mundane aspects of resort spas: heating and ventilation, and spring water piping.

Although the individual elements of the mechanical and piping systems at Hot Springs are not unique, their combination as solutions to specific circumstances makes the study of these systems particularly valuable. Virtually untouched since the closing of all but one of the bathhouses, the equipment in the vacant bathhouses are excellent examples of state-of-the-art mechanical systems, making their study and documentation worthy in the larger context of early twentieth century engineering.

This project is part of the Historic American Engineering Record (HAER), which documents the industrial and engineering heritage of the United States. HAER is administered by the National Park Service, United States Department of the Interior. The Hot Springs Bathhouses Mechanical Equipment Recording Project was co-sponsored by Hot Springs National Park, Roger Giddings, Superintendent; and the Southwest Cultural Resources Center, Dr. Richard W. Sellars, Chief.

Eldon Reyer, Associate Regional Director, Tom Vitanza, architect, and Diane Jung, historian, all of the Southwest Cultural Resources Center, recognized the need for documenting the mechanical systems since they would be removed as part of the proposed rehabilitation of the bathhouses. Funding for HAER documentation was secured through their efforts. In addition, Robert M. Vogel, Curator of Mechanical and Civil Engineering, National Museum of American History, Smithsonian

Institution; Herman Barkmann, consulting mechanical engineer; Euan F.C. Somerscales, Associate Professor of Mechanical Engineering, Rensselaer Polytechnic Institute; and Bernard Nagengast, American Society of Heating,Refrigeration and Air-Conditioning Engineers Historical Committee, provided invaluable consulting services by reviewing and commenting on the documentation.

Field work and documentation were prepared under the general supervision of Dr. Robert J. Kapsch, Chief, Historic American Buildings Survey / Historic American Engineering Record (HABS/HAER), Eric DeLony, Project Director, and William Lebovich, Architectural Historian. The field team consisted solely of Diane Prideaux-Brune, architect, Cornell University.

A BRIEF HISTORY OF HOT SPRINGS NATIONAL PARK AND THE AMERICAN SPA

"With wisdom born of inspiration, the lands embracing these wonderful healing springs were set apart as a reservation for the future disposal of the United States as early as 1832..."[3] As the first federally protected land in the United States, Hot Springs Reservation was indeed inspired, yet its very novelty made the administration of the property a trip into unexplored territory. Not only was the idea of public lands a new one, but by the time the hot springs and surrounding property came under federal protection, a number of private residences and bathing facilities had already been erected. Claims of private ownership were left unchallenged until 1870, when Congress passed a law designed to resolve the numerous title claims that had developed through half a century of private development. Despite the new legislation, Hot Springs Reservation was more name than fact.

A second Congressional Act provided for a commission to oversee the mapping and administration of the Reservation for the Secretary of the Interior. A clause in this 1877 act provided "that nothing ... shall prevent the Secretary of the Interior from fixing a special tax on water taken from said springs, sufficient to pay for the protection and necessary improvement of the same."[4] Since that time, the Department of the Interior, eventually through the National Park Service, has allowed concessionaires to construct bathing facilities on Reservation property, leasing the rights to the thermal water supply.

The last era of construction on Bathhouse Row began in the early years of the twentieth century. A number of water leases were due to expire at this time and discussion among Department of Interior officials revolved around the lack of adequate facilities on the Row. The older wooden bathhouses were constantly in need of repair, poorly ventilated and heated, and considered unsanitary as well as posing fire hazards. Officials at the Reservation were also considering the possibility of charging ground rent to the concessionaires on Reservation property, in addition to water lease fees. The Superintendent of the Reservation believed that, with high property values in the area, concessionaires were given an unfair advantage over other businesses not located on federal land. The two issues were resolved in the Secretary's decision to require rigid design and construction standards of each bathhouse concessioner, in exchange for the free use of Reservation property.[5]

The Maurice Bathhouse was the first bathhouse to be erected in the new era of Bathhouse Row. Designed by George Gleim, the Maurice was completed in 1912. That same year, the Buckstaff, designed by Frank Gibb, was completed on the site of the razed Rammelsburg Bathhouse. Architects Mann and Stern designed three facilities on Bathhouse Row - the Fordyce in 1915, and the Quapaw and Ozark Bathhouses in 1922. They also renovated the Hale Bathhouse in 1915, and developed a design proposal for the entire Row. The grand plan was never realized, but it did influence subsequent government construction and landscaping. The last bathhouse to be constructed was the Lamar, designed by Harry Schwebke in 1923. Each of these facilities were constructed at the lessee's expense, but the Department of the Interior maintained final design approval.[6]

The unusual combination of public ownership and private business interests has made Hot Springs unique in the federal lands system. Its popularity as a spa resort has been both an advantage and detriment to the development of Hot Springs National Park. The conflicts between federal officials and private businessmen cannot be overlooked, but the combination of spa facilities and protected natural lands made Hot Springs ideal for obtaining the greatest benefits from the thermal water and related therapies.

In general, American spas have had a rocky history. Unlike spa resorts in Europe, American resorts have not had strong support from the medical profession, and have often depended on the social aspects of bathing and relaxation to maintain a profit. Research into hydrotherapy, balneology, and physical therapy related to spa facilities has had limited impact on medical practices.[7] Those who propound these water-related treatments do so with a passion, but most Americans have traditionally considered spa therapy as a leisure pastime with little more than psychological benefits.[8]

The spas at Hot Springs enjoyed a rising popularity through the nineteenth century. As with American spas in general, Hot Springs tended to attract visitors interested in the peripheral pursuits, such as gambling, horse-racing, and entertainment, as much as the infirm who frequented the spa for relief.[9] Research into treatments for venereal disease and arthritis during the early twentieth century sparked a growing interest in the medical aspects of spa therapy, but the military and the two World Wars were the principal reasons for the growth of the bathing industry at Hot Springs. As a federally owned property with an increasing number of military facilities, Hot Springs became the center for the rehabilitation and recuperation of veterans. At its peak in 1945, bathing became so popular with the military that local hotels were taken over as residences for the temporarily-assigned soldiers.[10]

After World War II, Hot Springs suffered a marked decline in bathing popularity, as did the majority of spa resorts in the United States. In addition to the industry being overbuilt, a 1945 study listed other presumed causes of the decline:

> (a) The undefined status of spas in relation to health and medical care. (b) Failure of spa resorts to fulfill their mission. They have not served, adequately, sufficiently large groups or enough different types of people. (c) The attempt to combine pleasure with health procedures, the former receiving more emphasis than the latter. (d) Inability of private owners to finance resorts without public assistance. (e) Short seasons. (f) Lack of correlated clinical facilities and well rounded diagnostic services.[11]

Between the early 1960s and the 1980s, as the bathing industry declined, all bathhouses on Bathhouse Row allowed their government leases to expire, and ownership was transferred to the Park Service. In 1985, with the closing of the Lamar, only the Buckstaff Bathhouse remained in operation.

THE SPRINGS: THEIR COLLECTION, DISTRIBUTION, AND USE

The earliest bathing facilities in Hot Springs were merely pools collected along Hot Springs Creek that combined cold spring water with thermal water to establish a comfortable bathing temperature. The temperature of the mixed water dropped as one progressed downstream, and a large variety of bathing temperatures were thus available. Soon, a variety of regimens were developed by visitors to the springs. Some bathers chose to sit in a warm pool for hours; others took a short soak in a relatively hot pool followed by a plunge into cold spring water. Exposing an injured or painful limb to the force of fast running water at high temperature gave relief to many.[12]

Rheumatism, and joint and muscle pains were common complaints of visitors to Hot Springs. Typically, after the first two to three weeks of bathing daily, bathers experienced an aggravation of their earlier symptoms. At this point, many would become discouraged and leave off bathing. Those who persevered, however, soon found their ills and pains fading away. The layman's theory in the early years of the nineteenth century was that the spring water "unsettles the disorder and draws out the pain."[13]

Although the waters were considered a miracle cure by many who experienced their benefits, others had a more realistic attitude toward "taking the cure."

> "I would not pretend to hold out these springs as capable of performing sudden miracles; much of the benefit of any such report is occasioned by the improvement of the general health, the use of plain diet, freedom of the mind from corroding cares and from the circumstance that the whole attraction is given to one object, the improvement of health..."[14]

As Hot Springs became more widely known, and more frequently visited, rudimentary bathing facilities were constructed. As early as 1829, visitors to Hot Springs noted crudely constructed "sweat houses" of loose timber framing and blankets to enclose the rising vapors. The first bathhouse to be constructed was that of Asa Thompson in 1830 and consisted of a log cabin with a single wooden tub. By the mid-1830s, dressing rooms had been added to the few bathing structures. These bathing facilities of the 1830s were either constructed directly over the thermal water springs, or found their water supply by diverting a spring's flow through a series of wooden flumes.[15]

"Tub, spout, or vapour baths" were advertised in the 1840s, as the thermal bathing facilities became more extensive. The first bathhouse to provide extended services was opened in 1854 by John C. Hale. By this time, a typical bathing regimen would have consisted of a one to two minute bath in hot water, ten to twenty minutes in a vapor room, and a final shower and rubdown with a coarse towel.[16]

In 1860, David Dale Owens recorded ten bathhouses in operation in Hot Springs, most receiving their water supply from the wooden flumes resting on timber frames. The flumes were used to divert both thermal water and cold water to the bathing facility, where the two were mixed for a comfortable bathing temperature.

Post-Civil War construction brought more elaborate building and piping systems, and the beginnings of Bathhouse Row. Above ground, cast iron piping supplied thermal water to bathhouses and their reservoirs. Some of the hot thermal water was directed to "vats" and allowed to cool.[17] Five frame bathhouses were recorded in 1874, and by 1878, twelve bathhouses and three hotel bathing facilities were in operation.

When Congress brought Hot Springs under the exclusive authority of the Department of the Interior, and its Hot Springs Commission, in 1877, there was some concern over the method of thermal water supply. Little was done, however, to better organize the system. Private bathhouses continued to find their own water supply, but now did so with the permission of the federal government.

Records of bathing procedures became more precise after the Civil War, just as the bathing regimens themselves became more specific:

> In the first place you get into a hot bath--temperature about 92--stay there for about three minutes, timing yourself by a minute-glass; then you get out and stay three minutes more in a steam-box with your head out, or wrap yourself up in a blanket and sit on top of the steam-box for six to seven minutes, drinking hot water all the while from the mouth of a tin coffee pot which has been filled for you by the negro bath man. Result, tremendous perspiration.[18]

As the bathing procedures became more extensive, bathhouses began hiring attendants to help the bather. By the 1880s, bathing at Hot Springs had become not just an activity for the ill and infirm, but a fashionable pastime for the wealthy.[19] The benefits of the baths were also made available to the poor by an 1878 Congressional act providing free baths to indigents.

During these years of development at Hot Springs, water run-off from bathing facilities, and other waste, was allowed to run into Hot Springs Creek, which ran along the base of Hot Springs Mountain. Bathers could reach the bathing facilities by crossing the Creek on timber bridges. In 1884, a masonry vault was constructed over Hot Springs Creek, and then covered with earth, enclosing the fouled waters and providing a sidewalk in front of the bathing facilities. The Creek Arch marked the first major development in a planned thermal water system.[20]

The popularity of Hot Springs continued to grow, and by 1890, eleven bathhouses existed on "Bathhouse Row", five other bathing establishments had been built elsewhere in the area, and the second Government Free Bathhouse had been constructed. The bathhouses drew haphazardly from various individual thermal water sources, taking advantage of the springs higher up on the mountain to pressurize the pipes with gravity. Most facilities collected the thermal water in tanks on the roof.

Central Distribution

As the number of visitors to Hot Springs increased, shortages of thermal water during peak bathing hours occurred due to the inefficient and poorly maintained piping systems. The first government-built reservoir was constructed in 1880 to help alleviate the water shortage. The reservoir collected excess thermal water during periods of low demand, which could be used during subsequent peak periods. A second reservoir was constructed in 1881, and an attempt to protect the springs by capping was begun at this time. First with wood caps, and later with galvanized iron doors, the spring capping continued into the early years of the twentieth century.[21]

The first proposal for a more regular thermal water collection and distribution system was put forth in 1888 by Reservation Superintendent Samuel

Hamblen. Although Hamblen was replaced as Superintendent before any progress could be made on his plans, in 1891, Congress approved a $31,000 appropriation for the construction of a collection and distribution system along the lines of Hamblen's proposal.

Engineer George Baird was commissioned by the Secretary of the Interior to investigate the existing distribution system and to develop a plan for improvement. A new reservoir, a pump house, and collection and distribution pipes were constructed in 1891.[22]

Bathhouse owners, however, objected to a central distribution system because, through the years, individual springs had gained reputations for specific healing properties. The bathhouses had taken advantage of these beliefs to advertise their facilities. Owner opposition appears to be the cause of a mandate from the Department of the Interior in 1891, that pumping should not be used whenever distribution by gravity was possible, making the newly constructed system obsolete. The pumping station was eventually disassembled, but the reservoir remained in use as a collection point and gravity supply for more remote bathing facilities.[23]

The twenty-five-foot-deep impounding reservoir was constructed behind the Administration Building at the southern end of Bathhouse Row, and was designed to hold 260,000 gallons of thermal water, collected primarily from the springs located too low to supply any of the bathhouses by gravity. Water in excess of 260,000 gallons was released into the Creek Arch. Overflow lines were installed connecting the various reservoirs on the Reservation to the Impounding Reservoir in order to collect water that would otherwise have released into the Creek Arch as waste. A letter from the Superintendent to the Secretary of the Interior in 1909 reported that the reservoirs made possible an ample water supply, but complained of unequal distribution to the bathing facilities.[24]

In 1900, an 80,000 gallon reservoir was constructed on the northern end of Bathhouse Row, and a year later, a systematic program of marking and capping the thermal springs was instituted. The pumping station that had been constructed in 1891 and later disassembled, was reactivated in 1902 to better supply the bathing facilities not on Reservation property.

The Superintendent's 1904 annual report to the Secretary of the Interior listed the successful completion of four reservoirs. The first was the 80,00 gallon reservoir constructed in 1900. Nearby, a subsurface reservoir for the collection of water from a spring on the site was built. A cooling reservoir was constructed for the use of the Government Free bathhouse, and another, small, sub-surface reservoir was built between the Palace and Horseshoe bathhouses.[25] All reservoirs were supplied with overflow connections to the central impounding reservoir underneath the Superintendent's office.[26]

Although bathhouse interests opposed the construction of a centralized distribution system in 1891, by the 1920s, the quantity of water supplied to the bathhouses became a critical issue. Many bathhouses complained of the uneven distribution of thermal waters. The facilities near large springs were supplied with more than enough water for their needs, allowing the excess to drain into the Creek Arch unused. Other bathhouses were continually running short of thermal water and were forced to limit their business. Supply had become more important than the imagined qualities of individual springs. With the commercial opposition to a central system thus eliminated, the National Park Service was able to proceed with plans for a central collecting and distributing system, which was completed in 1931.

The construction of the Central Distribution system was overseen by J.B. Hamilton, assistant engineer to the Park Service, and was begun on December 29, 1930. The impounding reservoir built in 1891 was cleaned, waterproofed, and used as the central collecting point. The collecting pipes from the 1891 system, found to be deteriorated for the most part, were abandoned. A twelve-inch distribution pipe was installed from the collecting reservoir north along Central Avenue to a point between the Superior and Hale bathhouses. The line then ran east up Hot Springs Mountain to a 400,000-gallon concrete storage reservoir. A high pressure distribution system was also developed to supply the more remote facilities. A six-inch supply line followed the same path as the low-pressure line, and then ran north from the 400,000-gallon reservoir to another concrete reservoir higher up the mountain. A pumping station adjacent to the Administration Building was used to maintain the water supply to the two reservoirs. When the pumps were in operation, spring water flowing into the collecting main was pumped to the higher reservoirs. When these reached capacity, a float valve system automatically shut down the pumps, and the water in the main was allowed to flow into the impounding reservoir.

All the distribution lines were constructed of flanged steel with redwood insulation and rubber gaskets. The system operated at approximately 50 pounds per square inch (psi). The total flow from the springs was estimated at this time to be 850,000 gallons daily, at an average temperature of 142 degrees, as recorded by a Bristol recording thermometer installed in the impounding reservoir.

During the construction of the collection system, all known springs were opened, cleaned, and re-capped with brick and concrete tops. Many of the springs connected to the 1891 system were found to be leaking badly. The leaks were corrected, and new 3-inch outlet pipes were installed, connecting the springs to the collecting main.

From the distributing main along Central Avenue, 4-inch distributing pipes were brought to each bathhouse, and meters were installed.[27] Evidently, the original rubber meter disks proved inadequate for the high temperatures, and reinforced metal disks were installed as replacements only three months after the system was put into operation. A year later, the meters were still proving inadequate and water charges continued to be based on tubbage estimates.

Leaks in the main distribution lines were discovered shortly after the system was put into operation, as many of the bathhouses continued to complain of water shortages. Considerable time and park manpower was spent in penetrating the wood insulation in order to repair the piping by tightening the bolts around the rubber gaskets, but even after repairs, a few joints continued to leak water.

Once the distribution system was operating, the two reservoirs north of the Superior Bathhouse were drained and cleaned after being cooled by blowers. The 80,000-gallon reservoir was cleaned, and the partition removed. The smaller reservoir had a concrete floor installed. Both were connected to the main distribution system.[28]

Centralized Cooled Water

The thermal water supplied by the government after 1931 was cooled by tanks constructed by each of the individual bathhouses. The need for cooled thermal water had been a constant problem, as the quantity of cooled water necessary to regulate bathing temperatures far exceeded the amount of hot thermal water used. Original cooling systems consisted of storage tanks, typically of reinforced concrete, that were left open at the top and covered with a timber frame roof and wire screens. As the demand for cooled water increased, the cooling tanks proved inadequate, and a system of wooden baffle boards covered with screens was used to air cool the water before being stored in tanks.[29] Constant adjustments were made to the cooling towers to increase efficiency. The Maurice, for example, added a system of sprinklers to its cooling tank in order to increase the amount of water cooled.[30]

In the early 1920s, designs were considered for a community cooling tower that was to be funded jointly by the concessionaires on Bathhouse Row. Although the idea was never realized, it did cause considerable confusion as regards the construction of the Ozark and Quapaw bathhouses, as well as the design of the Lamar.[31] The Ozark and Quapaw facilities were built without cooling towers in expectation of the community system. As a temporary measure, the two bathhouses were allowed to use the cooling tank of the recently demolished Government Free

Bathhouse. Both facilities continued to use the Government Free tower until 1927, when a pair of matching towers was built on park property after the community tank plan was formally abandoned.[32]

The Fordyce appears to be the only bathhouse that varied in its water cooling design. A quantity of thermal water was directed into four stacks of cooling coils through which air for the heating and ventilation system was drawn. A cold water spray (city water, not from the springs) continuously showered the coils to increase their cooling capacity. Each stack was controlled by a thermostat and valve that released the water into storage tanks when the desired temperature had been reached. The system proved inadequate and in 1915, the management was forced to construct a cooling tower on the roof.

Surprisingly, when the cooling system design was submitted to the Superintendent for approval, no mention was made of utilizing the heat loss from the water to supplement the heating and ventilation system; the design was intended to only make use of the large volume of outside air being drawn into the building to cool the water. Mention was made of the benefits of the outside air passing through the cold spray, providing cleaner air for the heating system. The system was, however, the first attempt to protect the thermal waters within a closed piping system.[33]

The cooling tanks used by the bathhouses presented two fundamental problems to the park. First, park officials and officers in the Department of the Interior found the cooling towers to be unsightly. The unique situation of the commercial use of thermal waters on National Park property created the conflict of business versus the preservation and beauty of the natural environment, which was so much a part of park philosophy. Also, the baffle method of cooling the water was considered by many park officials and medical staff to be unsanitary and debilitating to the medicinal value of the waters. In 1936, the park Superintendent proposed the concept of a central cooling system under the control of the park, to supply cooled water to the various bathing facilities. World War II put a stop to any immediate action, however, and the centralized cooling system was not realized until 1948.

In describing the system, Superintendent Thomas Boles stated:

> This will not only do away with the present unsightly cooling towers, but will allow the spring water to be delivered to the tubs free from possible contamination and with all healing factors fully retained. A saving from evaporation will also be possible.[34]

Unlike the installation of the Central Distribution system, there appears to have been no opposition, on the part of bathhouse owners, to the cooling system proposed by the Park Service. Obtaining sufficient quantities of cooled thermal water for proper bathing temperatures had been such a long term problem for bathhouse operators that government control of a central cooling system could hardly have worsened the situation.

Designed by Park Service engineers, and overseen by J.B. Hamilton, the thermal water cooling system was begun on May 3, 1949 with the combined efforts of the Hot Springs National Park labor force and a crew of private contractors. The two major undertakings of the system were a heat exchange station at the north end of Bathhouse Row (on what is now Arlington Lawn), and a 100,000 gallon storage tank built on Hot Springs Mountain, west of the Row.

Water collected in the main reservoir at the Administration Building was pumped to a point referred to as 'M', between the Hale and Superior Bathhouses. From there, some water was directed east up Hot Springs Mountain to the newly constructed 100,000 gallon hot-water reservoir. The reservoir was built adjacent to the 1931 400,000-gallon reservoir and was constructed of reinforced concrete. The hot-water reservoir was equipped with vitrified-tile overflow and drain lines and was supplied by a 12-inch cast iron main. Pumps were installed at the new reservoir to supply the high pressure reservoir situated farther up the mountain.

Most of the water pumped to point 'M' was directed to the heat-transfer station north of the 80,000-gallon reservoir. The hot water was fed into pipes which were submerged in cooling water from cold springs and Hot Springs Creek. The system was designed to cool the water to approximately 90 degrees. After cooling, the water was then pumped to the 400,000-gallon storage tank (constructed in 1931 as part of that distribution system) which had been converted to cooled-water storage. The heat exchange was made up of four cooling units which could be used individually or together, depending on weather and cooled water demand.

The intake and supply lines for the central cooling and distribution system were made up of 12 and 8-inch cast iron pipes that were placed in the Creek Arch to augment the existing piping. Telemetering equipment was installed at each reservoir to record and control water levels, and flow meters were used at each bathhouse to monitor hot and cooled water use. A pumping station and settling basin were constructed at the site of the heat exchangers for supplying the

400,000-gallon reservoir. Two and four-inch supply pipes were laid to each bathhouse on the Row. The installation was completed on February 3, 1950 and the first cooled waters were supplied to bathing facilities on that day.[35]

The first indication of problems with the heat exchange system occurred less than a month after the system was put into operation. A "light addition" was made to the exchanger in March of 1950 to minimize the effect of sediment from the creek water. Clogging of the cold-water supply pipes was a continuing problem and cleaning of the pipes an ongoing maintenance project.

In addition to the problems of sediment resulting from the use of creek water, during times of minimal rainfall or high temperatures, the temperature of the creek water would sometimes rise above the projected 90 degrees cooled-thermal-water temperature. In 1954, the Park Service was forced to augment the creek water supply with city water.

Two cold-water wells were drilled in 1955 as a solution to the rising temperature of the cold water of the creek. The average temperature of the well water was found to be 68 degrees, and its use delayed any further modification of the cooling system until 1962.[36]

Apparently the combination of well and city water was insufficient to cool the thermal waters in the quantities demanded by the bathhouses, and in May of 1962, a contract was awarded to a local heating and plumbing firm for the installation of an air-cooled heat-exchange plant. The air-cooled system was then used as the primary cooling system, the water-cooled system being retained for high demand and emergency uses.[37]

BATHHOUSE HEATING AND VENTILATION

Various bathing regimens at the Hot Springs' bathhouses were developed through years of practical experience, and were modified by medical opinion and government regulation. As more importance was placed on sanitation by the medical field in general and Park Service officials in particular, heating and ventilation issues came under closer scrutiny.

A constant supply of fresh air into each facility was of primary concern to Park Service officials. The opportunity to improve ventilation and air purity in the bathhouses on the Hot Springs Reservation came about with the expiration of many water and ground leases in the early twentieth century.[38] The negotiation for new leases allowed officials of the park to administer more rigid building requirements for Bathhouse Row. Instead of charging lessees ground rent, which would have required an act of Congress, the Department of the Interior, on recommendation from the Reservation Superintendent, imposed a building and equipment standard on Reservation facilities. Although no formal requirements were set down, each design for facilities on government property underwent intense scrutiny by local officials, and architects and engineers of the Interior Department, before a lease was renewed and construction approved.

No accommodation for ventilation was made in the earlier bathhouses on the Row, and when rebuilding of facilities began, the Medical Director and Superintendent were anxious to enforce minimum ventilation requirements. Insuring proper heating and ventilation in the first bathhouse was recognized as establishing an important precedent for future facilities on the Reservation.

> (I)t is extremely desirable that adequate and satisfactory ventilation and heating be provided for all the new bath houses, and yet there is involved here a problem quite different from that in the application of similar principles to other buildings. If the ventilation produces noticeable draughts so that the bathers are chilled there will be many objections, they will cash in their tickets and go elsewhere where there is no ventilation, and it will be difficult to require other houses to provide any ventilation.[39]

First recommendations from the Medical Director were for the complete exchange of air five times every hour. That proposal was later increased to six times in an hour, on recommendation from experts at the Department of Interior.

The heating requirements in each bathhouse varied depending on the activity in each zone. Typically, heating requirements were as follows:

Hot Rooms--125 degrees F
Bath Halls--100 degrees F
Hot Pack Rooms-- 110 degrees F
Cooling Rooms-- 75-85 degrees F
Halls, Reading Rooms, Offices-- 70 degrees F[40]

Although degree specifications did vary, in general the aim was to insure a gradual cool-down of the bather's body temperature, and the zoned temperatures reflect each bathhouse's order of procedure for the bather.

The heating system had to have a seasonal flexibility, as well as an internal control system. Heating needs became the primary concern in the winter months, as the movement of such large volumes of outside air, often at freezing temperatures, required a powerful system of heat exchange. In summer months, ventilation and air flow were of importance to the comfort of the bather.

The specific sources of the heating and ventilation systems used in the bathhouses are unclear. The designs were made up of stock elements available at the time, and correspondence suggests that other government facilities used similar systems.[41] Whatever its origin, the combined multi-zoned forced air and direct radiant heating system became the overwhelmingly common choice on Bathhouse Row, for its flexibility, air movement, and economy.

The first bathhouses to be rebuilt on the Row during this period of strict federal requirements were the Buckstaff and the Maurice. It fell to the owners and designers of these facilities, then, to develop a system of heating nd ventilation that would conform to the Department of Interior standards, while keeping costs to a minimum during a time when the concern for fire-proof construction and rising materials costs were increasing the capitol investment for new bathhouses.

The stock units used in the forced air (termed "blast air" at the time) heating systems were assembled into multi-zone heating and ventilation arrangements that conformed to the space limitations and heating needs specific to each bathhouse. The interest in these systems is that they are relatively unchanged since their installation in the early years of the twentieth century, and demonstrate their adaptable nature to extreme variations in use, and heating and ventilation needs. The multi-zone system in a more developed form is still used today as a common method of providing the needs of multi-use buildings, and the early principles of these systems can clearly be seen in the bathhouse equipment.

Description of a Typical Heating/Ventilation System

Each bathhouse accommodated two boilers, working in tandem, to supply steam to the heating system. Low-pressure cast iron sectional boilers were the most commonly used, but fire-tube and tube-in-shell units were also used. Some boilers were originally coal-burning, but all boilers eventually burned oil or gas. Examples of the types of the double boiler system originally used can be seen in the Quapaw, Buckstaff, Hale, Ozark, and Fordyce.[42]

The boilers were installed so that both would supply steam; or, in the case of a boiler failure, or during the low demand seasons, either unit could work independently. The entire heating system worked under boiler pressure, which was regulated by automatic controls and blow-off valves.

In general, the forced air systems in the bathhouses were multi-zone, automatically operated systems of heated air propelled by a blower. After being heated, the air was distributed throughout the building through mixing dampers, which were adjusted automatically to provide the desired temperatures to each zone.

Steam, at boiler pressure, was supplied to two sets of coils: tempering and heating. The tempering coils were set on concrete or brick piers that provided a passage through which the air could be directed without passing through the coils. Some of these by-pass chambers were controlled by galvanized iron dampers to regulate the volume of air passing through or under the coils.

From the tempering coils, the air, which had been heated to an average temperature of 60 degrees, passed into the blower itself. Most often of sheet steel, the blower chamber contained one or two sheet-steel fans, either paddle or squirrel-cage type, that were driven by an electric induction motor. It appears that the only original flat drive belts remaining are those in the Superior and Buckstaff bathhouses. Both are of rubberized canvas.

The blower forced the tempered air through a second bank of steam coils. These heating coils were also set above a by-pass chamber. Beyond the coil and by-pass combination was the plenum chamber, which was divided into two parts. At the base of the plenum was the tempered-air chamber, directing the cooler air into the flues. Above the tempered-air chamber was the hot-air chamber. At the base of each flue leading to the various zones of the building was a combination of a draft regulator and damper that mixed the tempered and heated air to the appropriate temperature. Each auto-mixing combination was controlled by a pneumatic thermostat.

A thermostat was located in each zone of the building. The temperature in a particular zone was recorded by a mercury thermometer. Mercury pressure adjusted the air pressure in pneumatic tubes connecting the thermostat to a draft regulator in the plenum. As the pressure varied with temperature, the draft regulator was moved by a bellows motor to adjust the mixing damper to the appropriate proportion of hot and tempered air going into the flue.

The base of each air duct was equipped with two galvanized steel plates on a steel frame, which made up the mixing damper. Each plate was positioned to vary the opening into the plenum. As the plate to the tempered-air chamber rotated, increasing the opening, the plate to the hot-air chamber reduced its opening. The plates were so placed that when one completely closed off any air flow, the other allowed maximum flow. Thus, air temperature could be regulated while maintaining constant volume.

Beyond the mixing dampers, the ducts were equipped with balancing dampers. These dampers could be manually adjusted by a quadrant control to regulate the volume of air entering the zone. None of the blower had any means for regulation, and the balancing dampers provided a simple means for adjusting air flow into the ducts.

The position of the air registers in each room varied from bathhouse to bathhouse. Concern for drafts on wet bathers made the position of the registers critical. Most often, the heat register was placed at head level. Registers for venting the air were placed at floor level. Apparently, drafts were a problem despite careful placement of the registers, as many of the floor level registers were covered with white or black japanned iron grills.

None of the bathhouses appear to have allowed for the use of return air in their original designs.[43] The displaced air simply was released from the rooms via the venting ducts, to an attic space or roof ventilator. In some cases, it appears that the only method of releasing the vitiated air was through the windows.

Direct Radiant Heating

The radiant heating systems in all the bathhouses demonstrated little variation. The tandem boilers supplied steam to the radiators, which were regulated by pneumatic thermostats.[44] The thermostats regulating the radiators controlled the amount of steam from the boilers.

Both single- and double-pipe radiators were used on the Row. Single-pipe systems used the same piping for both steam supply and condensate return. Every bathhouse was equipped with a condensate return system in the form of an electrically-driven vacuum pump. The vacuum pump drew condensation from all steam coils and radiators for reuse in the boilers.

In most cases, the radiant system was divided into two portions. One set of radiators was designed to work year round and provide heat to the bath halls, pack rooms, and cooling rooms as necessary. The second set was to be shut down during summer months when heat requirements were at low.

Surprisingly, only one bathhouse design appears to have made any allowance for basement ventilation. The natural heat from nearby thermal springs (some actually located in the basements themselves), the constant burning of fuel in the boiler room, and the later addition of laundry facilities created what would seem to be an unbearable atmosphere. Frequently, the employee lounges were located in the basement. Although attitudes toward labor were less enlightened in the 1920s, these basements would have certainly tested anyone's endurance.

The Ozark was equipped with a fan that directed outside air through a tunnel and into the boiler pit area. In 1915, the manager of the Hale Bathhouse requested recommendations from the Superintendent on solving the problem of its unbearably hot basement, but there is no evidence of a reply. These examples are the only evidence that the problem of basement ventilation was ever addressed.

Individual Heating and Ventilation Systems

The basic heating and ventilation systems established by the Buckstaff and

Maurice were adopted by all but one of the bathhouses to be built on the Row during this period of construction. Variations occurred in each instance, but the theory of a multi-zoned system was a part of every design.[45] (See HAER Nos. AR-4-A through AR-4-I for individual structure reports.)

ENDNOTES

1.Richard Kovacs, M.D., "The Problem of the American Spas," Journal of the AMA, 127 (Jan-Apr 1945): 978.

2.Department of the Interior, Laws and Regulations Relating to the Hot Springs Reservation, Hot Springs, Ark., (Washington, D.G.: GPO, 1908), p.5.

3.Martin A. Eisele, Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior 1905, (Washington, D.C.: GPO, 1905), p.3.

4.Department of the Interior, Laws and Regulations Relating to the Hot Springs Reservation, Hot Springs, Ark., (Washington, D.G.: GPO, 1908), p. 7.

5.W. Scott Smith, Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior 1907, (Washington, D.G.: GPO, 1907), p. 8; and Harry H. Meyers, Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior 1911, (Washington, D.C.: GPO, 1911), pp. 7-9.

6.Department of the Interior, National Park Service, Bathhouse Row Adaptive Use Program, Technical Reports 1-7, (Denver, GO: Denver Service Genter, 1985).

7.Hydrotherapy is defined as the medical use of water for the treatment of certain diseases. Balneology describes medical therapies using mineral waters.

8.Henry E. Sigerist, "American Spas in Historical Perspective," Bulletin of the Institute of the History of Medicine, 11 (1942):133-138.

9.Ibid., p.138.

10.Francis J. Scully, M.D., "Spa Therapy of Arthritis and Rheumatic Disorders," Archives of Physical Medicine, 127 (April 1945):238.

11.Kovacs, "The Problem of American Spas," p.978.

12.Arkansas Gazette, (Little Rock), August 26, 1829, p.1; and Francis J. Scully, Hot Springs Arkansas and Hot Springs National Park, (Little Rock, AR: Pioneer Press, 1966), pp. 37-38.

13.Arkansas Gazette, August 26, 1829, p.1.

14.Ibid.

15.Arkansas Gazette, August 26, 1829, p.1; and Scully, Hot Springs Arkansas and Hot Springs National Park, p. 38.

16.Irene Jones, "Hot Springs: Ante-Bellum Watering Place," The Arkansas Historical Quarterly 14 (Spring 1955):19-20.

17.Dee Brown, The American Spa: Hot Springs, Arkansas, (Little Rock, AR: Rose Publishing Co, 1982), p.34.

18.Arkansas Gazette, August 7, 1872, p.4.

19.Dee Brown, The American Spa, pp. 30-35.

20.Scully, Hot Springs, Arkansas and Hot Springs National Park, p.109.

21.William P. Parks to the Secretary of the Interior, Monthly Reports, June 1915 to January 1916, HSNP Archives.

22.Department of the Interior, Report on Hot Springs Reservation, (Washington, D.C.: GPO, 1909), pp.4-5.

23.Ibid.

24.George L. Collins, Report of the Superintendent of Hot Springs Reservation for the Fiscal Year Ending June 30, 1931, HSNP Archives; and W. Scott Smith to the Secretary of the Interior, April 6, 1909, HSNP Archives.

25. These structures were located on the site of what is now the Quapaw Bathhouse.

26.Martin A. Eisele, Report of the Superintendent of Hot Springs Reservation to the Secretary of the Interior, (Washington, D.C.: GPO, 1904), p.6.

27.Ibid, and Department of the Interior, "Hot Water Distribution System as Constructed in 1931," Drawing, (San Francisco, CA: 1930), HSNP Archives.

28.J.B. Hamilton to National Park Service Director, Monthly Status Reports, December, 1930 to November, 1931; Dr. George L. Collins to National Park Service Director, Annual Report, October 20, 1931, HSNP Archives; Thomas J. Allen to National Park Service Director, Annual Report, 1932, HSNP Archives; and Department of the Interior, "Hot Water Distribution System as Constructed in 1931," drawing on file at Hot Springs National Park.

29.Martin A. Eisele, Report of the Superintendent of Hot Springs Reservation to the Secretary of the Interior, (Washington, D.C.: GPO, 1904), p.336.

In 1920, owners of the Superior Bathhouse erected a steel tank behind their building in order to obtain a greater supply of cooled water. This tank appears to have been the only one of its kind. [J.H. Avery to Superintendent Hot Springs National Park, Oct. 7, 1920, HSNP Archives.].

30.Joseph Bolten to Manager Maurice Bathhouse, June 21, 1929, HSNP Archives.

31.Architects Mann and Stern submitted plans for the community cooling tank conforming to their own "beautification scheme" for Hot Springs. The architects succeeded in designing and constructing the latter Quapaw and Ozark cooling towers.

32.Sidney M. Nutt to Superintendent Hot Springs National Park, Nov. 18, 1922, HSNP Archives; Grant Hammerer to Superintendent Hot Springs National Park, Feb. 10, 1923; Joseph Bolten, M.D. to Director National Park Service, July 11, 1925, Sept. 3, 1925, and May 17, 1927, HSNP Archives.

33.G.R. Mann to Superintendent Hot Springs Reservation, Nov. 11, 1913, HSNP Archives.

34.Thomas Boles to National Park Service Director, Annual Report, 1947, HSNP Archives.

35.J.B. Hamilton to National Park Service Director, Monthly Reports, May 1949 to March 1950, HSNP Archives.

36.Donald S. Libbey to National Park Service Director, Monthly Reports, December 1952 to August 1955, HSNP Archives.

37.Robert H. Atkinson to National Park Service Director, Monthly Report, May 1962, HSNP Archives.

38.See Appendix A for lease expiration dates.

39.Harry M. Hallock to the Secretary of the Interior, May 2, 1911, HSNP Archives.

40.Harry Schwebke, Building Specifications for the Lamar Bathhouse, 1923, HSNP Archives.

41.A June 6, 1911 letter from the Assistant Secretary of the Interior to the Hot Springs Reservation Medical Director states that the proposed heating and ventilation system designed for the Buckstaff was "substantially" the same as those installed in the Government Hospital for the Insane in Washington D.C., and a school in Lawton, OK, both built by the Department.

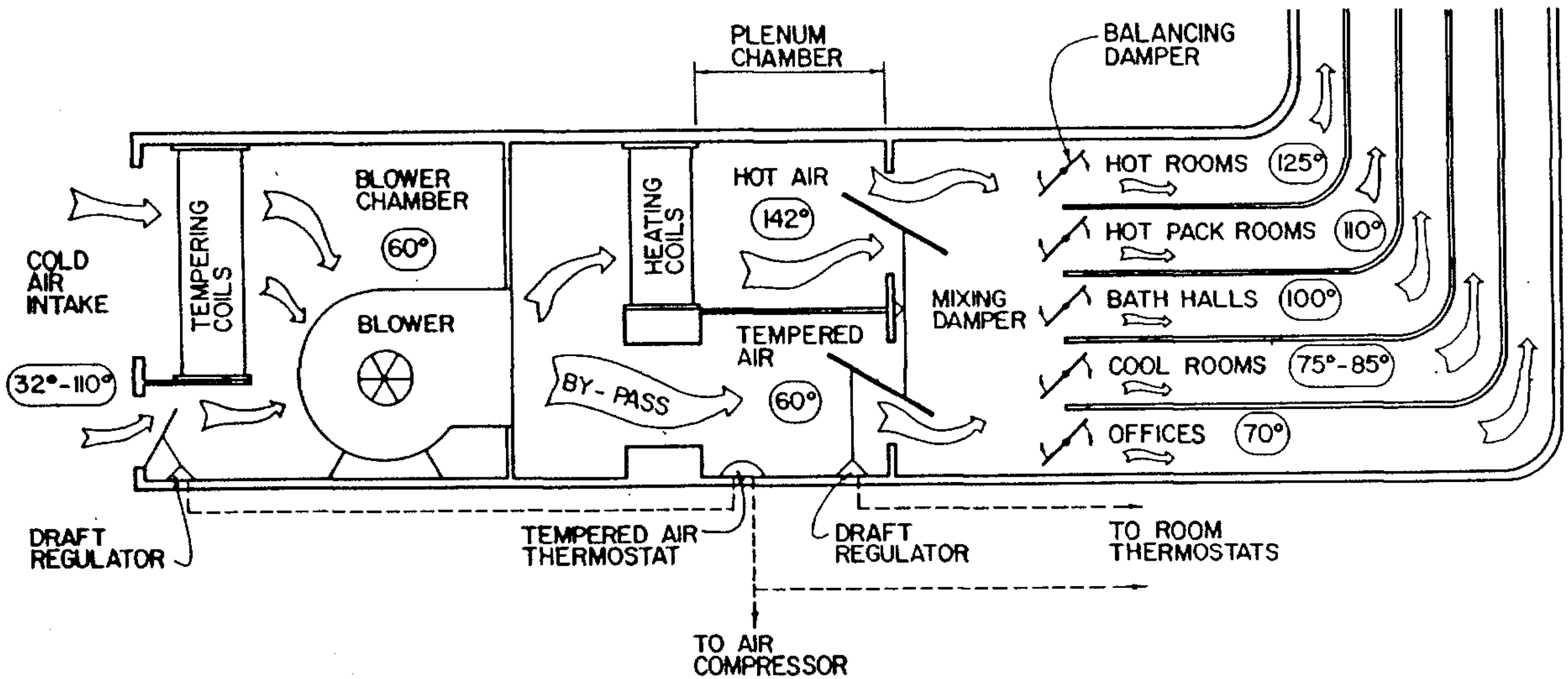
42.The Fordyce boilers have been cleaned and painted, the original asbestos covering having been removed. The Lamar has a single original boiler extant. The original boilers in the Maurice were replaced in the 1930s by steel high-pressure fire-tube boilers.

43.The Lamar appears to have added a form of return in a later remodeling of the bath house. A duct connecting the first floor hall to the men's dressing room appears to be used as a minor return air system.

44.The original thermostats which are extant reveal pneumatic connections. The Lamar also has a pneumatic regulator system and its construction is the latest. The electric thermostats that appear in a few of the bathhouses appear to be later additions. A detailed study of all the bathhouse building specs would be necessary to definitely establish this point.

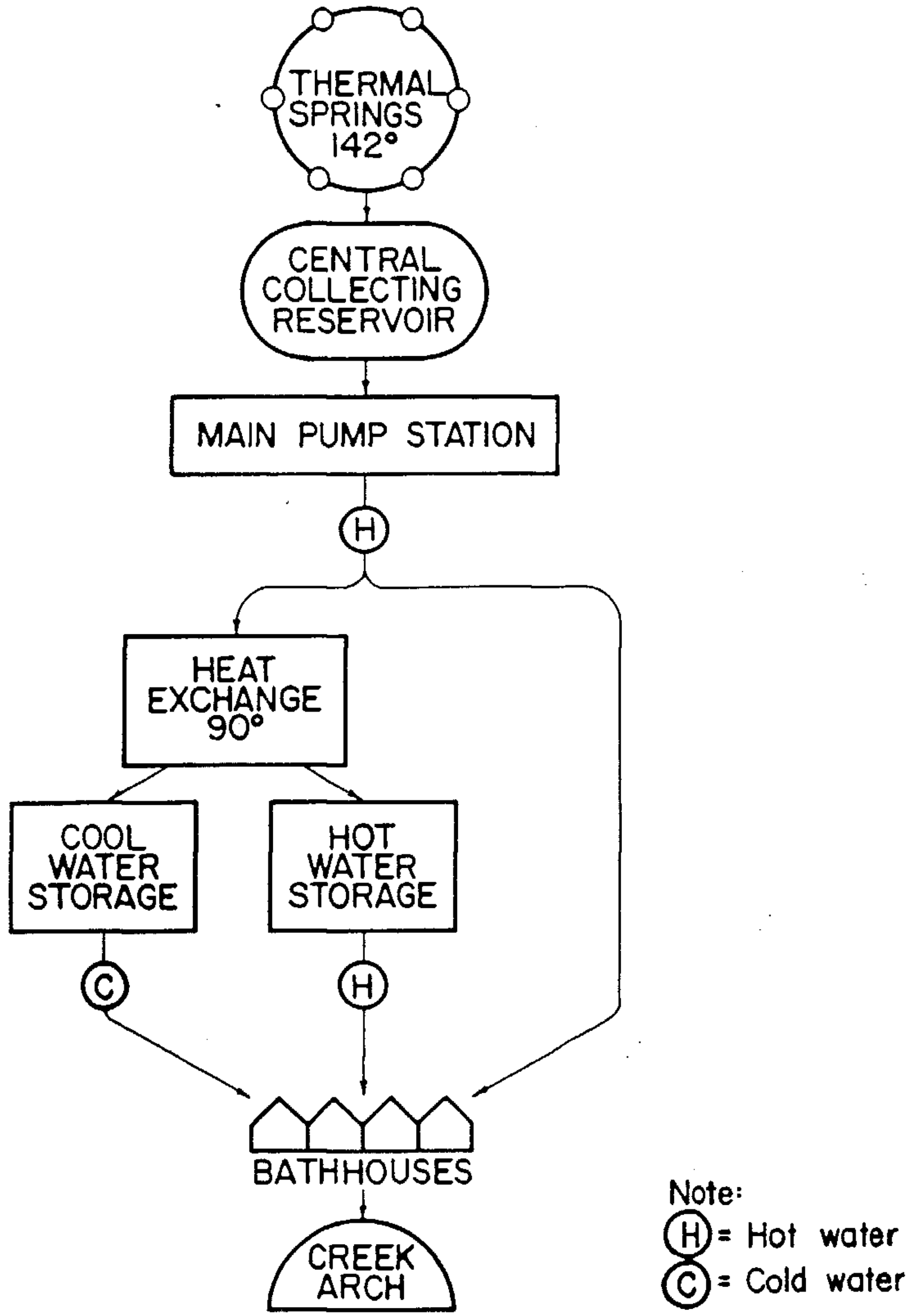
45.All information on the individual bathhouses is based on available building specifications and drawings on file at Hot Springs National Park and the National Archives, as well as on-site observation.

MULTI-ZONED FORCED AIR VENTILATING SYSTEM



This schematic shows the multi-zoned heating and ventilating arrangement typical to the Hot Springs Bathhouses. Virtually unchanged from their installation in the 1920's, the mechanical equipment and multi-zoned system demonstrate heating and ventilating principals used in modern buildings today.

THERMAL WATER SUPPLY SYSTEM



Schematic representation of water flow typical to bathhouses documented. It shows flow from source to sewer.

APPENDIX 2: LEASE EXPIRATION DATES AND DATES OF NEW CONSTRUCTION

	Expiration Date	Construction Date
RAMMELSBURG*	01-01-09	01-01-12
MAURICE	12-31-16	01-01-12
HALE	12-31-07	01-01-15
PALACE**	12-31-06	01-01-15
SUPERIOR	09-14-06	02-15-16
HORSESHOE***	12-31-09	02-01-22
MAGNESIA***	12-31-09	02-01-22
OZARK	01-01-14	07-01-22
LAMAR	12-31-16	01-01-26

*site of Buckstaff Bathhouse
**site of Fordyce Bathhouse
***site of Quapaw Bathhouse

APPENDIX 3: HOT SPRINGS BATHHOUSES HEATING AND VENTILATING SYSTEMS: AN EVALUATION OF THEIR HISTORICAL SIGNIFICANCE

Prepared by: Robert M. Vogel
Curator of Mechanical & Civil Engineering
National Museum of American History
Smithsonian Institution

Eric N. DeLony
Chief & Principal Architect
Historic American Engineering Record

We inspected the mechanical systems of the seven disused bath houses along "Bathhouse Row" on 22 & 23 April 1987, and Vogel alone examined those in the still-active Buckstaff Bath and in the present NPS Visitors' Center on the 23rd. Additionally, we examined a short length of the Creek Arch (or Culvert) running beneath Central Avenue in front of the Row in the company of Chief Ranger for Interpretation, Earl Adams on the 22nd.

The history of the Hot Springs facility is thoroughly documented in numerous federal, commercial, scholarly, and popular accounts and will not be mentioned here. Further, Lamar Bathhouse mechanical systems were evaluated from the standpoint of rehabilitation feasibility by consulting mechanical and electrical engineers in June of 1986 (See Barkmann report).

The present examination was to:

1) Determine whether any of the surviving mechanical equipment in the buildings is of historical significance, at any level;

2) If so, recommend the extent of preservation and recording desirable and reasonable with respect to perceived significance and planned building modifications;

3) The same for Creek Arch.

SIGNIFICANCE OF BATHHOUSE MECHANICAL EQUIPMENT

It is important to note at the outset that we are unaware of the existence in this country of a single person who could be construed as "the" or even "an" eminent authority on the historical development of building mechanical and electrical systems. There has been a modest amount of research on the subject - principally in connection with specific buildings under restoration, and there have been (very) occasional articles on heating and ventilating ("HV" as we will refer to it here after) in the journals of architectural history. Each of us has examined a number of systems of various dates and degrees of complexity in the course of our recording, preservation, and like professional pursuits, which cumulatively have provided us with a general qualitative background on the subject. This, we feel, is adequate to the task of making the judgements that follow. These judgements, however, should be regarded as neither ultimate wisdom nor hard and fast dogma to be followed in the conduct of the proposed alterations to the bathhouses. Furthermore, as we are unaware of the detailed plans for the buildings to be modified, we cannot address the question of "threat" to any of the significant artifacts, as the planned changes may or may not affect them.

Before making any specific recommendations, we will observe generally that none of the systems taken as discrete entities, and no single element of any of the HV systems, can be considered to be of outstanding historical value. Literally every component is stock, commercial unit of conventional design and use for the period (ca. 1910-1925, with numerous later replacements). What <u>is</u> unusual about the collected system, however, is that they represent an interesting solution to a particular, rather unusual HV problem that essentially was consistent - with only minor variations - among the eight bathhouses. The problem, of course, was that of maintaining a very close level of comfort heating during a season that ran well into the cold months, while at the same time introducing (and heating) large volumes of outside air to prevent excessive humidity buildup in the face of the extraordinary atmosphere of hot, moisture-laden vapor.

Perhaps most distinctive of the systems is their two-level feature: heating directly by conventional steam radiation, and indirectly by steam "coils" in the forced-air ventilating system, the mixing of warmed and unwarmed air being thermostatically controlled in some of the bathhouses. (A curious aspect of the Hot Springs Bathhouses HV system is that apparently, not until very recently, was any attempt made to utilize for heating the vast quantities of heat dumped to the atmosphere in the process of cooling the spring water to a comfortable bathing temperature. This now is being done in the Buckstaff Bathhouse, but seemingly for the first time. According to Interpreter Adams, the apparent justifying philosophy behind this curious waste was that the spring waters traditionally were regarded as essentially "sacred," to be employed solely for bathing and therapeutic purposes, and that the drawing of any of their heat energy for practical purposes would somehow compromise their efficacy).

The HV components common to each of the bathhouses are:

1) A pair of horizontal heating boilers - either steel-shell flue or cast iron - originally coal fired but converted to natural gas. Nearly all of these appear to be original equipment. Some are equipped with a vacuum return system.

2) Direct radiation in the non-bathing rooms with occasional instances of indirect convectors in the bathing rooms.

3) A forced-air ventilating system drawing in outside air, passing it over steam coils, and distributing it via a heated-unheated air mixing chamber to the bathing and other high humidity areas. Air propulsion is (was) by large belt-driven squirrel-caged steel-case blowers. There was no recirculation; air apparently was discharged through room windows or vents (not observed).

4) Conventional steel water-supply and cast-iron waste plumbing for baths and sanitary systems - the former of rather larger capacity than customary for rapid filling and emptying of the bathtubs.

PRESERVATION RECOMMENDATIONS

Ideally, the complete HV system of one bathhouse should be preserved in situ - with full interpretation - to represent for the historian and the visitor alike an important element of the bathhouse infrastructure at the high point of the spa's development during the period just prior to and following the First World War. As it is unlikely that this will be practically possible in the face of various proposed rehabilitation projects, we would recommend the following:

1) Complete photographic documentation of all principal mechanical components of all bathhouses including therapeutic water treatment devices still extant. Photographic documentation of all readily visible features of the hot springs, the plumbing and mechanical equipment that distributed, cooled, stored and wasted the waters.

2) A schematic diagram showing the typical heating and ventilating system in the bathhouses. A schematic showing how the waters are drawn from the springheads and or wells, piped to the reservoirs and heat exchangers, distributed to the baths, and wasted to the Creek Arch Culvert under Central Avenue.

3) Written description of the typical heating and ventilation system including a schedule of related mechanical equipment in the bathhouses. Written description of the thermal water system.

PHYSICAL PRESERVATION

Taking the in situ preservation of a single complete system as an unlikely if not impossible eventuality, we recommend establishment of a permanent exhibit of "The Means Employed to Warm and Ventilate the Bathhouses at Hot Springs During its Heyday" (or some such title). This logically would be located in the basement of one house, and be centered on at least one of the original boilers and the combined air handling system with its entire outfit of organs. The smaller, above-stairs elements: a radiator or two and possibly an indirect convector, could be exhibited as well, their relationship to the system indicated by photographs and (say) the HAER schematic diagram.

We repeat that in the absence of information on the future uses of the specific bathhouses, we cannot recommend a particular site for such an exhibit. We would note, however, that the Quapaw would be a likely candidate: its steel return-tube boilers are clearer expositions of boiler technology than the cast-iron units in most of the other bathhouses, and most of the pneumatic damper controls in the mixing chamber survive. The Lamar would be a good second choice; the boilers are cast iron but the pneumatic controls are more complete than in any of the other houses.

If the above plan is not feasible because of commercial demands for the space that would be required, then a poor alternate would be the preservation of selected key components in isolation, away from their native sites. With appropriate supporting graphic material, such a collection still would be capable of providing the visitor with some of the meaning, appearance, and operation of these systems. In this case we would recommend removal and preservation of the following:

1) The front two feet or so of one of the Walsh & Weidner boilers in Quapaw be cut off to represent (with its auxiliaries) the typical heating boiler;

2) The American Blower Co. blower with its motor and controller from the Superior (the only one retaining its original flat-belt drive) and at least one bank of steam coils;

3) A representative section of the Lamar mixing-chamber wall with several pneumatic damper motors and dampers;

4) (Assuming that it is disused) the operation panel of the Van Auken vacuum return system in the Buckstaff;

5) A selection of radiators;

6) Several of the pneumatic thermostats from the Maurice:

7) The small air compressor, loose on the floor of the Quapaw's northmost basement room - presumably the one that furnished air for the damper-control system.

OTHER MECHANICAL-ELECTRICAL EQUIPMENT OF NOTE

Notable in various of the bathhouses are a number of other items of original equipment of sufficient historical interest that should at least be recorded, and preserved if possible:

1) In the Maurice and Superior: open-front lighting panels with branch switches and plug-fuse holders, presumably disused. These lend themselves to relatively simple preservation in place, with the possibility for brief interpretation.

2) In the Maurice: two Otis elevators (identical: for men and for women), presumably contemporary (1911) and apparently unmodified except for shaft enclosure to meet fire codes. The bottom-mounted, electric drum type machines and their controls (and the cars) are absolutely standard but, as with the HV equipment, play a distinct role in the story of the Hot Springs Bathhouses. As such, the preservation of one (or both?) is well worth consideration - again, in place or the setting of historical exhibit.

3) Typical examples of the industrial washing machines, dryers and ironers that laundered, dried, and ironed towels and sheets. Every homemaker in America will relate to these artifacts.

THE CREEK ARCH

Our examination of the arch itself and study of its background suggests that while of considerable significance in the development of the park and town, its place in the history of American civil engineering is so minor as to be almost nil. By the mid-1880s, when the arch was constructed, stone-masonry construction was as sophisticated as it ever was to be, whether for use in buildings, bridges, tunnels, or other forms of construction. Nothing of this is displayed here. The Creek Arch (mis-named; really a cut-and-cover tunnel) is a simple, straightforward, unadorned, inexpensively-built utilitarian continuous arch or culvert of modest proportions. Despite the considerable bureaucratic haggling that surrounded the project, both the design and construction themselves were routine for the period.

As with the mechanical systems discussed above, the obvious means for preserving the arch - on the basis of its local significance - would be in continued service. If there is no plan to discontinue that, then the matter is resolved. If on the other hand, the arch's function is to be altered and its alignment is to be preempted for some other purpose, then we would recommend preservation of a short section wherever possible, with appropriate interpretation describing its major role in the town's development as a spa. Presumably the arch is documented on official plans and drawings, and has been photographed. If not, this could easily be done by HAER, and should be.

SELECT BIBLIOGRAPHY

Arkansas Gazette 1829, 1872.

Bedinger, S. Valley of the Vapors: Hot Springs National Park. Philadelphia, PA: Eastern National and Monument Association, 1974.

Brown, Dee. The American Spa: Hot Springs, Arkansas. Little Rock, AR: Rose Publishing Company, 1982.

Cromwell, Neyland, Turemper, Millett and Gatchell, Inc. "Historic Structure Report, Hot Springs National Park." Unpublished. On file at Hot Springs National Park, 1973.

Cron, Frederick W. "The Hot Springs of the Ouachita." Manuscript. On file at Hot Springs National Park, 1946.

Cutter, John Milton, ed. Cutter's Official Guide to Hot Springs, Arkansas and the United States Government Reservation: The World's Greatest Health Resort. Charles Cutter and Son: 1913.

Department of the Interior. Laws and Regulations Relating to the Hot Springs Reservation, Hot Springs, Ark. Washington, D.C.: Government Printing Office, 1908.

--------. Report on Hot Springs Reservation. Washington D.C.: Government Printing Office, 1909.

Department of the Interior. National Park Service. Manual Governing the Operations of Bathhouses at Hot Springs National Park, Arkansas. Hot Springs, AR, ca. 1955.

--------. Bathhouse Row Adaptive Use Program, Technical Report No. 1: The Bathhouse Row Landscape. Technical Report No. 2: The Superior Bathhouse. Technical Report No. 3: The Hale Bathhouse. Technical Report No. 4: The Maurice Bathhouse. Technical Report No. 5: The Fordyce Bathhouse. Technical Report No. 6: The Quapaw Bathhouse. Technical Report No. 7: The Ozark Bathhouse. Denver: Denver Service Center, 1985.

Eisele, Martin A. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior. Washington D.C.: Government Printing Office, 1905.

--------. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior for the Year Ended June 30, 1906. Washington D.C.: Government Printing Office, 1906.

Hallock, Harry M. Report of the Medical Director of the Hot Springs Reservation to the Secretary of the Interior. Washington D.C.: Government Printing Office, 1911.

Hanor, Jeffery S. Fire in Folded Rocks: Ceology of Hot Springs National Park. Eastern National Park and Monument Association, 1980.

Haywood, John Kerfoot. The Hot Springs of Arkansas: Report of an Analysis of the Waters of the Hot Springs on the Hot Springs Reservation, Hot Springs, Garland County, Ark.. Washington, D.G.: Government Printing Office, 1902.

Hot Springs National Park Archives. Manuscript Material.

Johnson Service Company. "The Last Word in Temperature Regulation." No publisher. No date. On file at Johnson Controls Inc., Milwaukee, WI.

--------. "Johnson System of Temperature Control." No publisher. No date. On file at Johnson Controls Inc., Milwaukee, WI.

Jones, Ruth Irene. "Hot Springs: Ante-Bellum Watering Place." The Arkansas Historical Quarterly. 14 (Spring 1955):3-30.

Kovacs, Richard. "American Spas." Hygeia. 17 (March 1939):207-91.

--------. "American Health Resorts: The Problem of the American Spas." Journal of the American Medical Association 127 (Jan-Apr 1945):977-981.

Lautman, M.F., M.D. Arthritis. Hot Springs, AR: Levi Memorial Hospital: no date.

Maeder, Richard H. "Steeped in Hot Water: The Establishment and History of Hot Springs National Park."Manuscript on File at Hot Springs National Park. No date.

Meyers, Harry H. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior. Washington D.C.: Government Printing Office, 1910.

--------. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior for the Fiscal Year Ending June 30, 1912. Washington D.C.: Government Printing Office, 1912.

--------. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior for the Fiscal Year Ending June 30, 1913. Washington D.C.: Covernment Printing Office, 1913.

Norsworthy, Stanley Frank. "Hot Springs, Arkansas: A Geographic Analysis of the Spa's Resort Service Area." Ph.D Dissertation, University of California at Los Angeles, 1970.

Owens, David Dale. Second Report of a Geological Reconnaissance of the Middle and Southern Gounties of Arkansas, Made During the Years of 1859 and 1860. Philadelphia, PA: C. Sherman & Son, Printers, 1860.

Parks, William P. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior for the Fiscal Year Ending June 30, 1915. Washington D.C.: Government Printing Office, 1915

Pitts and Associates Engineers, P.A., and Witsell and Evans, Architects-Planners. "Interior Report, Phase Two, Testing on Site, Investigative Study of Five Bathhouses." Unpublished. On file at Hot Springs National Park, 1984.

Rhodes, Diane. Historic Grounds and Structures: An Interim Report on Bathhouse Row, Hot Springs National Park, Arkansas. Denver, CO: U.S. Department of the Interior, 1985.

Scully, Francis J. Hot Springs, Arkansas and Hot Springs National Park: The Story of a City and the Nation's Health Resort. Little Rock, AR: Pioneer Press, 1966.

--------. "Spa Therapy of Arthritis and Rheumatic Disorders." Archives of Physical Therapy 127 (April 1945):233-238.

Sigerist, Henry E. "American Spas in Historical Perspective." Bulletin of the Institute of the History of Medicine 11 (1942):133-147.

Smith, W. Scott. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior. Washington D.C.: Government Printing Office, 1907.

--------. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior. Washington D.C.: Government Printing Office, 1908.

Trowbridge, C.R. Report of the Superintendent of the Hot Springs Reservation to the Secretary of the Interior for the Fiscal Year Ending June 30, 1914. Washington D.C.: Government Printing Office, 1914.

U.S. Geological Survey. The Waters of Hot Springs National Park, Arkansas-- Their Nature and Origin. Washington, D.C.: Government Printing Office, 1979.

DRAWINGS:

"Boilers for Hot Springs Distribution - 1889" No date. On file at Hot Springs National Park.

Department of the Interior. National Park Service. Branch of Development. "Central Cooling and Distribution System, Hot Springs National Park." #NP-HS/5311-C. 1948. On file at Hot Springs National Park.

Department of the Interior. National Park Service. Office of Chief Engineer. "Electrical Installation - Hot Water Pumping Plant, Hot Springs National Park." San Francisco, CA: 1930. On file at Hot Springs National Park.

--------. "Hot Water Distribution System as Constructed in 1931." San Francisco, CA: 1930. On file at Hot Springs National Park.

Department of the Interior. National Park Service. Division of Engineering. "Hot and Cooled Water Distribution System as Constructed 1931 and Expanded 1949." No date. On file at Hot Springs National Park.

Mann, Eugene John, and Stern, Architects. "Water Tanks for Maurice, Fordyce, Quapaw, and Lamar Bath Houses, Hot Springs National Park." Little Rock, AR: 1922. On file at Hot Springs National Park.

Mann, Eugene John, Architect. "Detail of the Tanks for Quapaw Bath House, Hot Springs National Park." Little Rock, AR: Sept.14,1927. On file at Hot Springs National Park.